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(56) Documents Cited
DE 019536116 A
FR 002785376 A
US 6082447 A

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(54) Abstract Title

A heat exchanger with isolated cooling circuits

(57) A heat exchanger (1) with a number of isolated cooling circuits; in particular a heat exchanger unit for an automobile, having a cooling circuit for operating as a condenser for an air conditioning system and a cooling circuit operating as a transmission oil cooler for vehicle transmission. The heat exchanger comprises two manifolds (4,16) which are connected to a heat exchanger core comprising a plurality of tubes (6-13), in which each manifold has a pair of baffles (14,15,17,18) positioned either side of a redundant tube (9), such that two isolated circuits are formed, and the redundant tube does not form part of either circuit.

A hole (23,24) in the manifold wall between the pair of baffles enables leak testing to be performed.

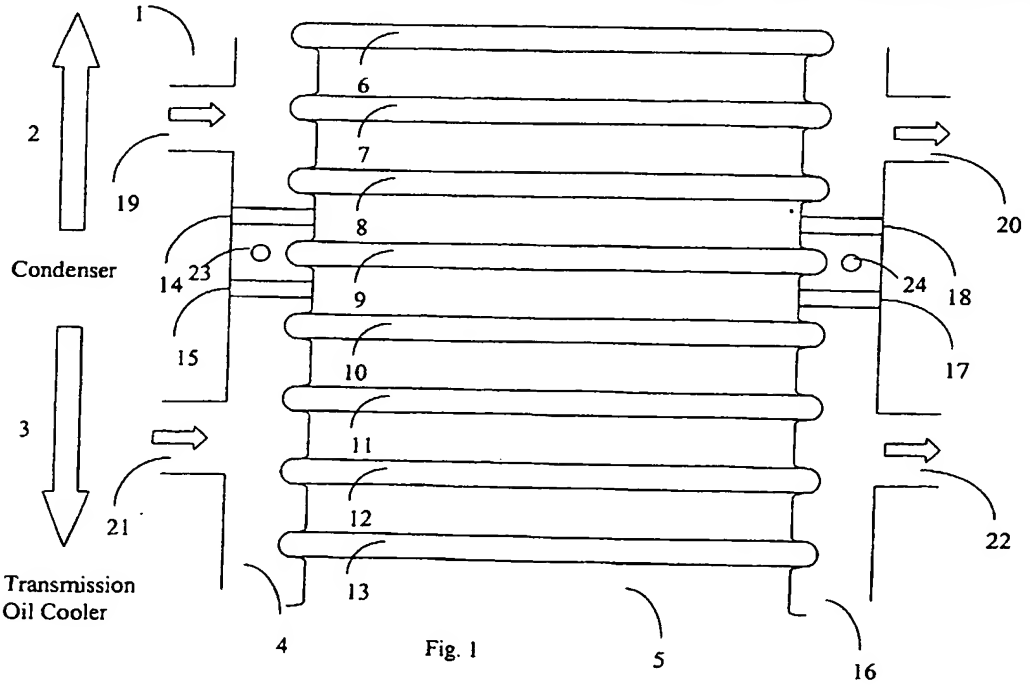

Fig. 1

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At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

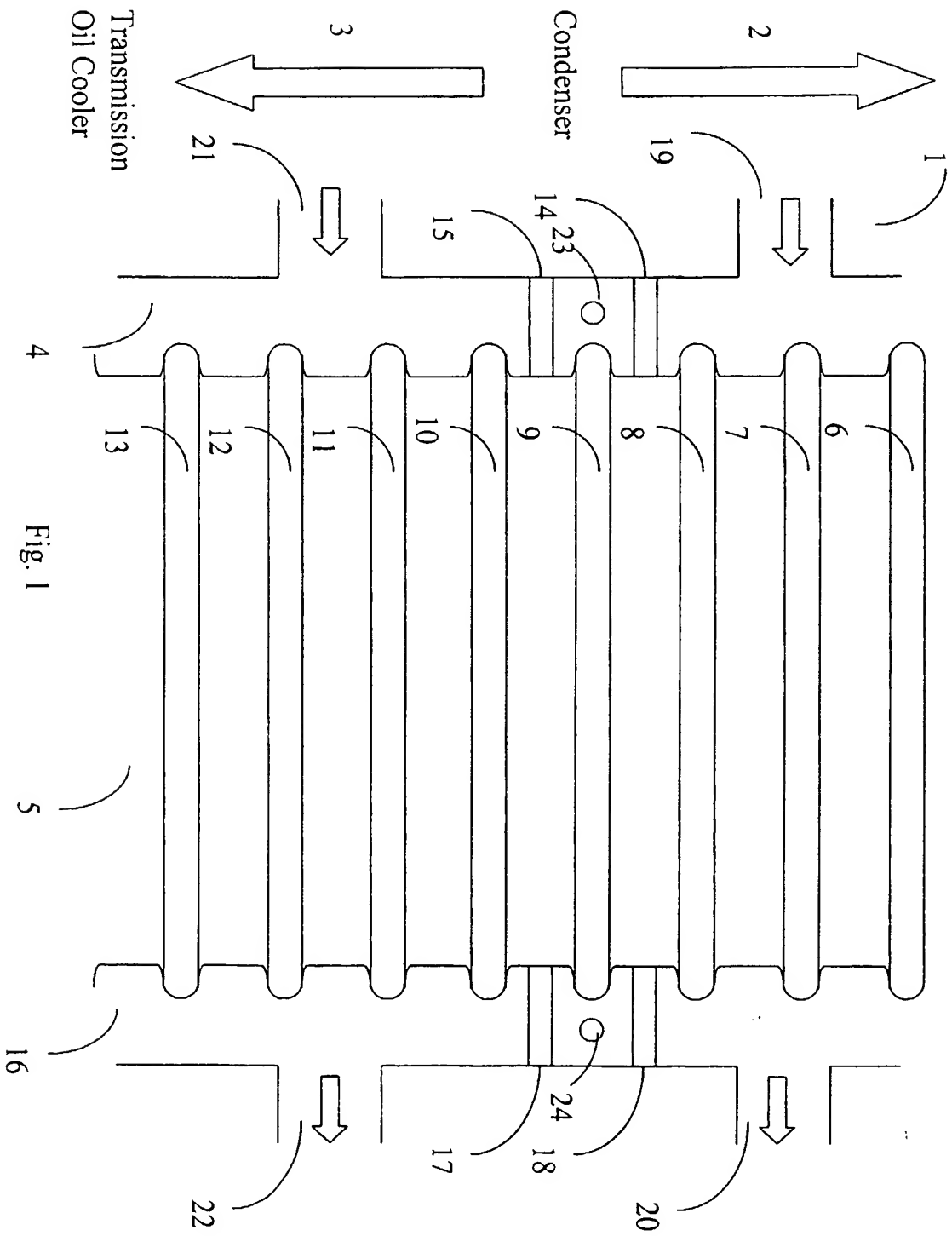

Fig. 1

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HEAT EXCHANGER

This invention relates to a heat exchanger with a number of isolated cooling circuits. In particular, although not exclusively, a heat exchanger unit for an automobile having a cooling circuit for operating as a condenser for an air conditioning system and a cooling circuit operating as an oil cooler (TOC) for transmission or other systems requiring cooling.

Heat exchangers of the type to which this invention relates have manifolds to which a large number of refrigerant/cooling tubes are connected. The refrigerant/cooling tubes usually have fins that are mounted between the tubes, and the tubes and fins together form a heat exchanger core. Fluid in the form of a refrigerant or coolant flows from the manifold through the refrigerant/cooling tubes, and when the fluid passes through the tubes it is in heat exchange relationship with another fluid flowing past the tubes.

In a typical motor vehicle cooling circuit, coolant passes through the vehicle engine and its temperature rises. It then passes through the radiator, entering the radiator through the manifold and then passing through cooling tubes where air flows over the tubes to remove heat from and to reduce the temperature of the coolant before the coolant is re-circulated via a second manifold to the vehicle engine.

In a typical air conditioning circuit a refrigerant absorbs heat from the interior passenger compartment via an evaporator. The gaseous refrigerant is then compressed to create a superheated vapour that enters a cooling circuit which acts as a condenser. As the vapour passes through the cooling circuit, heat is removed from the refrigerant by the air flow over the tubes to reduce the temperature of the refrigerant thus condensing the gaseous refrigerant, resulting in high pressure liquid refrigerant leaving the condenser. The liquid refrigerant flows through a pressure relief system, to reduce the pressure of the refrigerant, and continues the air conditioning cycle to provide the required passenger comfort

It is known for heat exchangers to have more than one isolated cooling circuit. For example, US 6082447 uses a dual baffle assembly to isolate an air conditioning circuit from an oil cooling circuit. It is an advantage for such heat exchangers to provide a thermal barrier between the two heat exchange circuits. In DE 19536116 a solid rod is used to provide a thermal barrier between two circuits, and in FR 9313893 a shortened tube is similarly used to provide a thermal barrier between cooling circuits.

A problem with such known heat exchangers having two cooling circuits is that specially manufactured core assemblies are required in order to provide a thermal barrier between the two circuits.

According to the present invention there is provided a

heat exchanger comprising:

two manifolds which are connected to a heat exchanger core comprising a plurality of tubes, in which each manifold has a partition positioned either side of a redundant tube, such that two isolated circuits are formed, and the redundant tube does not form part of either circuit.

It is advantageous for leak testing if one manifold has a hole for use during leak testing positioned between the pair of baffles. Preferably each manifold has a hole for use during leak testing positioned between the pair of baffles.

In a preferred embodiment of the invention the heat exchanger is provided for use in an automobile in which one of the isolated circuits is a cooling circuit for an air conditioning system and one of the isolated circuits is a transmission oil cooler for a transmission system.

In another embodiment the heat exchanger is provided for use in an automobile in which one of the isolated circuits is a refrigerant circuit for an air conditioning system and one of the isolated circuits is an oil cooler for use by a power assisted steering device.

An embodiment of the invention will now be described, by way of example only, with reference to the accompanying drawing in which

Figure 1 illustrates a heat exchanger according to the present invention.

Figure 1 illustrates schematically part of a heat exchanger 1 for an automobile in which has a cooling circuit 2 for operating as a condenser for an air conditioning system and a cooling circuit 3 operating as a transmission oil cooler (TOC) for a transmission system.

The heat exchanger 1 comprises a manifold 4 which is connected to a heat exchanger core 5. The heat exchanger core 5 comprises a plurality of tubes 6, 7, 8, 9, 10, 11, 12, 13. In the schematic illustration of Figure 1 fins associated with the tubes are not shown. A pair of baffles 14, 15 are positioned either side of tube 9. Similarly, a second manifold 16 is connected to the heat exchanger core 5. the second manifold 16 also has a pair of baffles 17, 18 positioned either side of the tube 9. Thus tube 9 opens into the space between each pair of baffles 14, 15 and 17, 18.

Air conditioning refrigerant flows into part of the manifold 4 via inlet 19. The refrigerant flows through tubes 6, 7, 8 (and other tubes, not shown) where it is cooled by air flowing over the tubes and associated fins. The refrigerant fluid circuit can take many forms throughout the heat exchanger, Figure 1. is an example having a single pass fluid flow. The condensed refrigerant is then re-circulated to the air conditioning system, passing out of the cooling circuit 2 via part of the second manifold 16 and outlet 20.

Transmission oil flows into part of the header tank 4 via inlet 21. The oil flows through tubes 10, 11, 12, 13 (and other tubes, not shown) where, in a similar manner to the air conditioning refrigerant, it is cooled by air flowing over the tubes and associated fins. The cooled oil is then re-circulated to the vehicle transmission, passing out of the cooling circuit 3 via part of the second manifold 16 and outlet 22.

Redundant tube 9 does not form part of either cooling tube 9 serves as a thermal barrier between the air conditioning cooling circuit 2 and the transmission oil cooling circuit 3. It will be appreciated that more than one redundant tube could be used to form a single barrier, and that more than two separate coolant circuits could be created using a second redundant tube elsewhere in the core 5.

The manifold 4 has a hole 23 in the space between the baffle 14 and the baffle 15. The hole, together with the baffles 14, 15 and redundant tube 9, serves to aid pressure leak testing. Leak testing is performed by pumping helium into the cooling circuit under test. For example, when cooling circuit 2 is to be tested, helium is pumped into inlet 19, and the heat exchanger 1 is monitored for leaking helium. Any leak across the baffle 14 will be detected by helium leaking through the hole 23. Similarly, when cooling circuit 3 is tested, any leak across the baffle 15 will be detected by helium leaking through the hole 23.

Thus, the twin partition arrangement described, together with a suitably positioned leak testing point (i.e. hole 23), has a testing advantage over single baffle arrangements for provision of twin cooling circuits. Leaks across a single baffle, or dual baffle arrangements where there is no space between the baffles, are extremely difficult to detect as it is inconvenient to provide a suitable leak testing point.

In the embodiment of the invention shown in Figure 1 the manifold 16 also has a hole 24 in the space between the baffle 17 and the baffle 18. The hole 24, together with the baffles 17, 18 and redundant tube 9, also serves to aid pressure leak testing, as a leak across either one of the baffles 17, 18, will be detected more readily by detecting a leak via hole 24, although it will be appreciated that such leaks could be detected at hole 23, as the testing gas would flow through hole 23 via redundant tube 9.

CLAIMS

1. A heat exchanger comprising:

two manifolds which are connected to a heat exchanger core comprising a plurality of tubes, in which each manifold has a pair of baffles positioned either side of a redundant tube, such that two isolated circuits are formed, and the redundant tube does not form part of either circuit.

2. A heat exchanger according to claim 1 in which one manifold has a hole for use during leak testing positioned between the pair of baffles.

3. A heat exchanger according to claim 2 in which each manifold has a hole for use during leak testing positioned between the pair of baffles.

4. A heat exchanger according to any one of the preceding claims for use in an automobile in which one of the isolated circuits is a cooling circuit for an air conditioning system and one of the isolated circuits is a transmission oil cooler for an engine oil system.

5. A heat exchanger according to any one of the preceding claims for use in an automobile in which one of the isolated circuits is a cooling circuit for an air

conditioning system and one of the isolated circuits is an oil cooler for use by a power assisted steering device.

6. A heat exchanger substantially as herein described with reference to the accompanying drawing.

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Application No: GB 0116618.0
Claims searched: All
Examiner: Rosalind Lyon
Date of search: 23 October 2001

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.S): F4S (S8, S42A, S42Z)

Int Cl (Ed.7): F28F 1/00, 9/02

Other: Online Databases: WPI, EPODOC, JAPIO

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
Y	US6082447	NORSK HYDRO AS Fig 1 and p 4, col. 3 lines 57-67 to col. 4 lines 1-3. Describes double baffle method for leak testing.	2,3
X	DE19536116A1	BEHR GMBH&CO See especially figs 1 and 2, p 3, lines 40-47. Partition member 11 acts to separate two heat exchanger circuits	1 at least
Y			2,3
Y	FR2785376	VALEO THERMIQUE MOTEUR See especially figs 1 to 4. Describes two heat exchanger circuits separated by an inactive tube.	1

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.